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GB 2173905 A GB 0979616 A EP 0185804 A1
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(71) Applicant(s)
Thermocouple Instruments Limited
(Incorporated in the United Kingdom)
Pentwyn, Cardiff, South Glamorgan, CF2 7XJ,
United Kingdom

(72) Inventor(s)
Richard Edward Julian Cornelius

(74) Agent and/or Address for Service
Urquhart-Dykes & Lord
Three Trinity Court, 21-27 Newport Road, CARDIFF,
CF2 1AA, United Kingdom

(54) Abstract Title
A ring shaped temperature sensor mounting for inside a pipeway.

(57) A sensor arrangement for sensing the temperature of a fluid flowing along a pipeway, comprises a sensor ring 33 mounted within a passage in a body and arranged for the fluid to pass through the sensor ring, and a temperature sensor 35 positioned against the outer surface of the sensor ring.

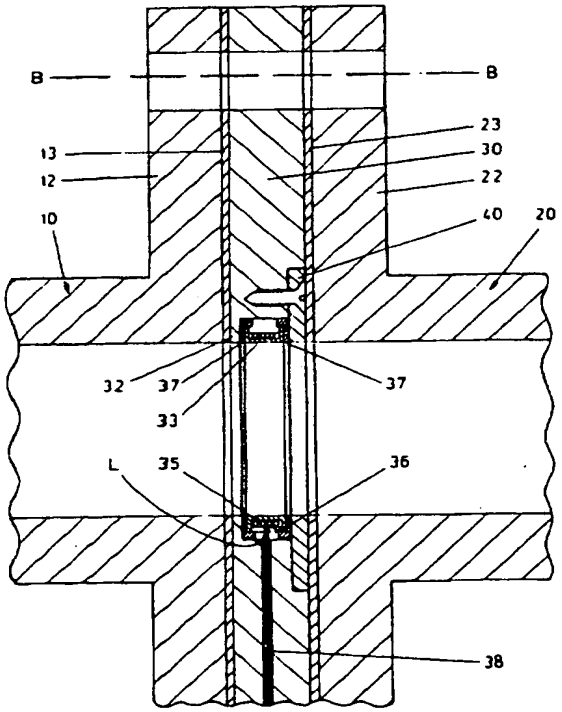

FIG. 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1995

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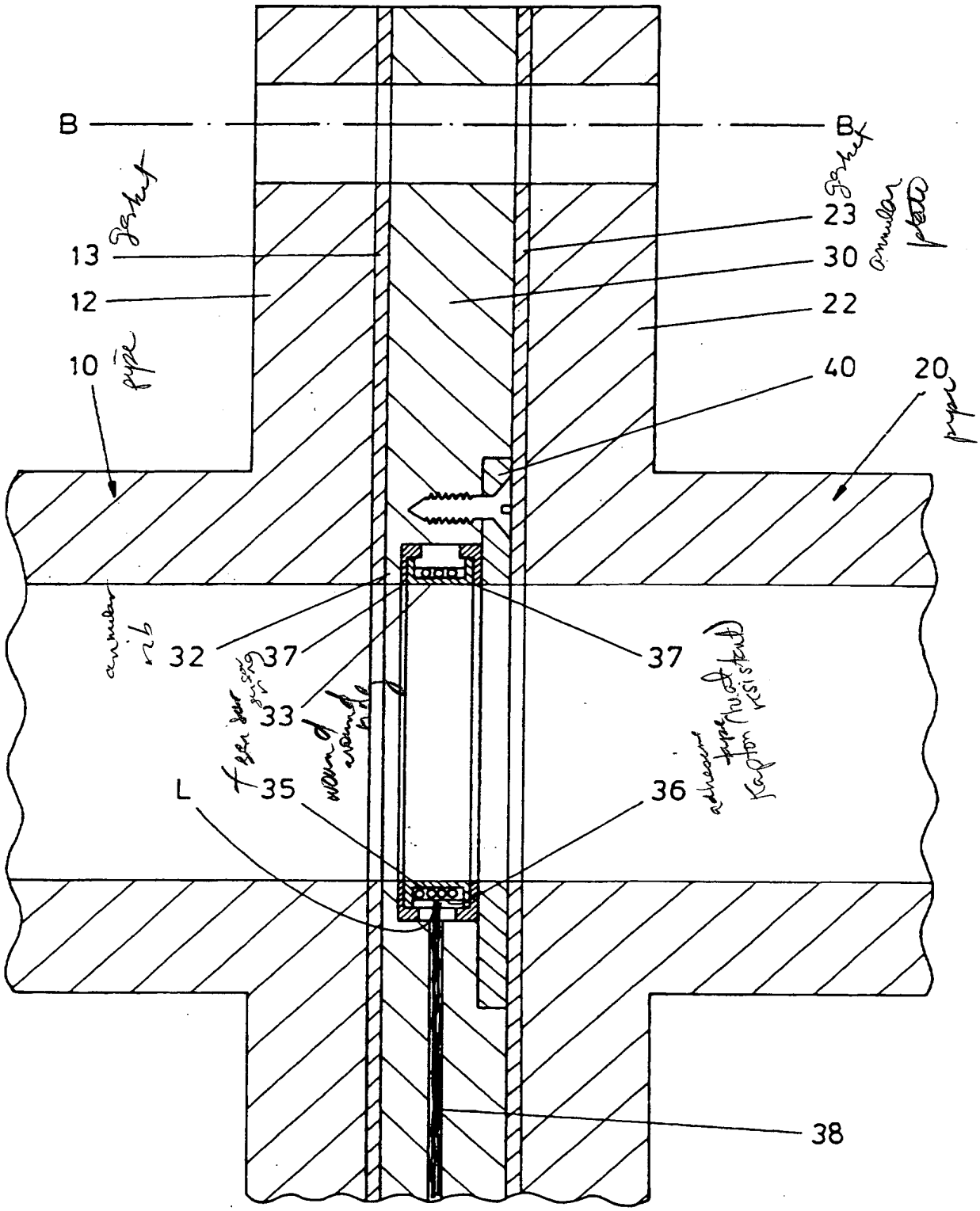

FIG. 1

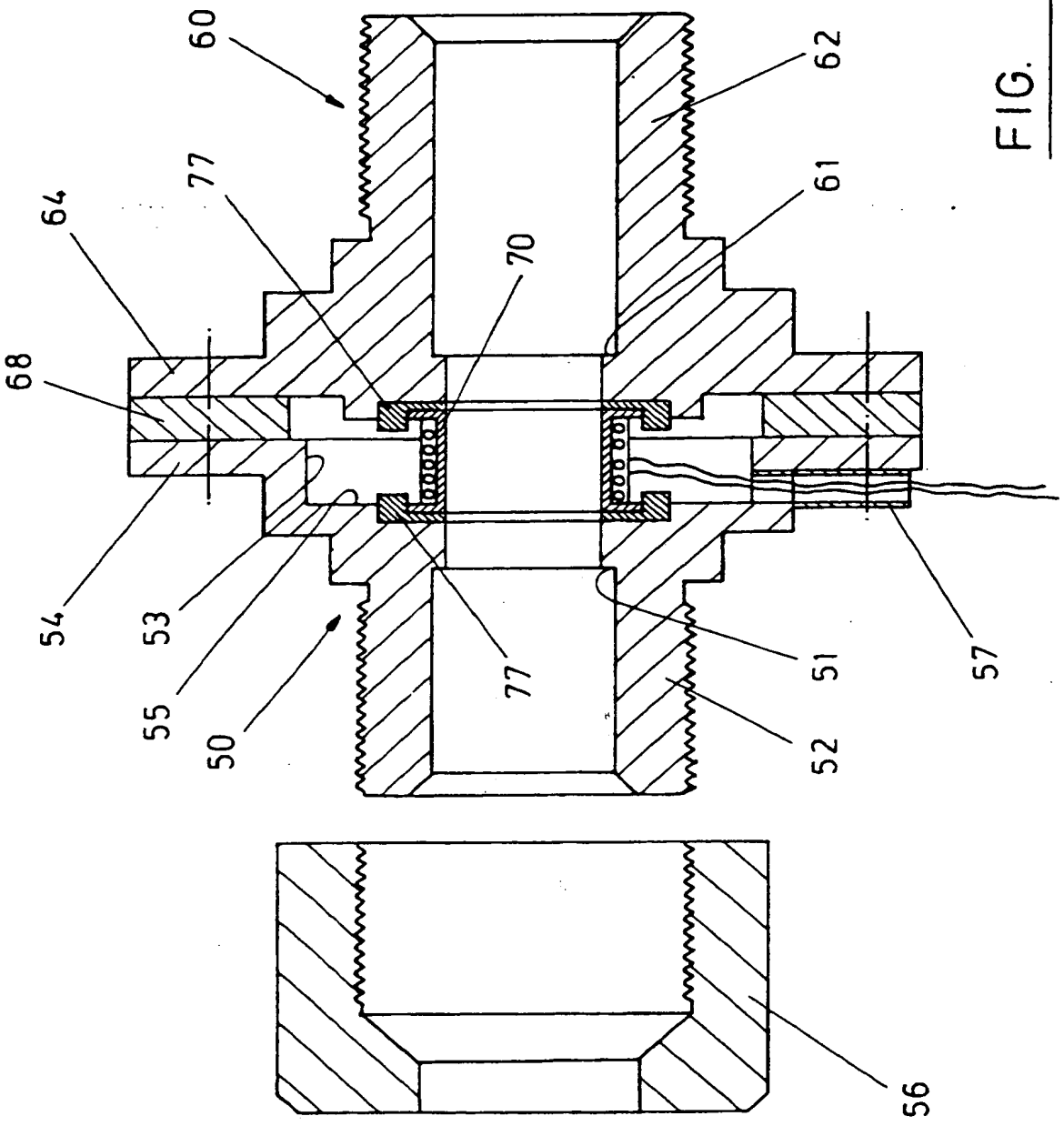

FIG. 2

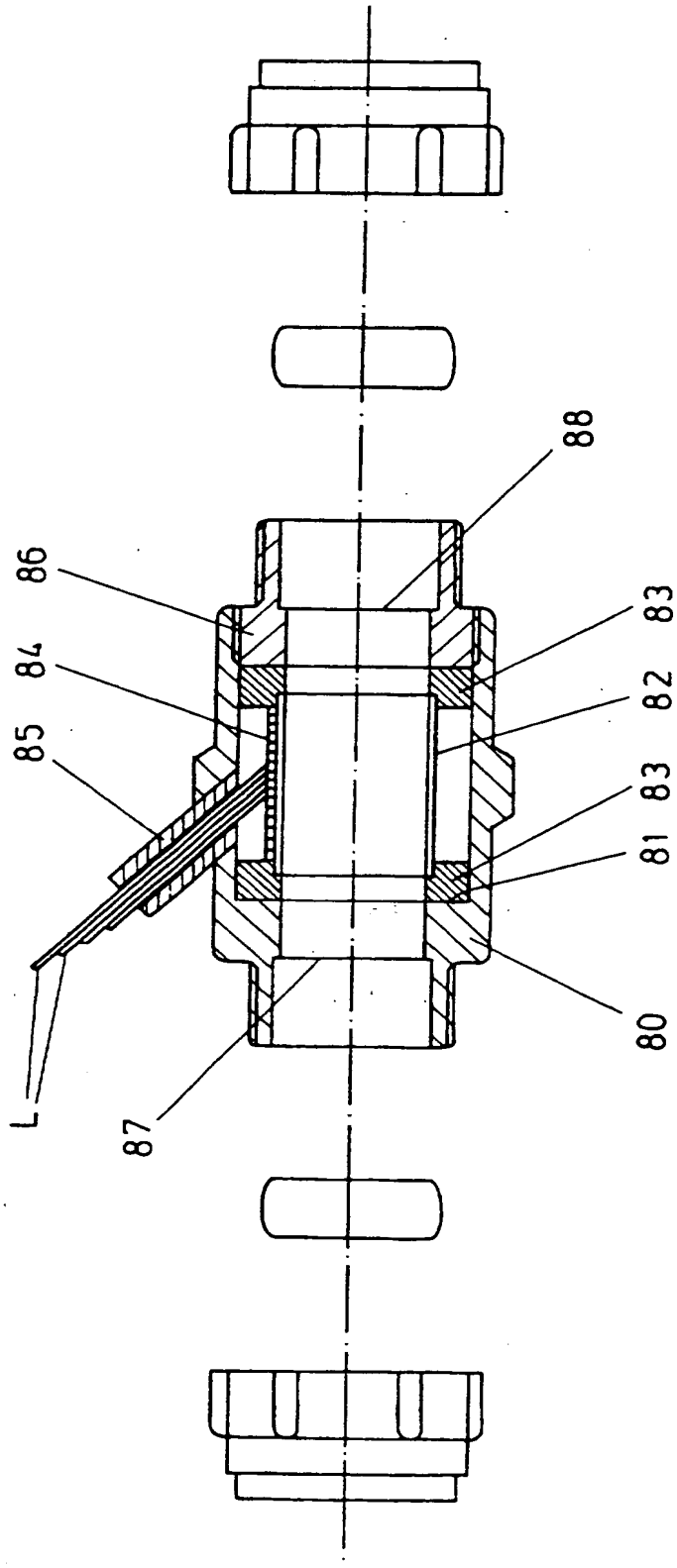

FIG. 3

Temperature Sensor

The present invention relates to an arrangement for sensing the temperature of a fluid flowing along a pipeway.

The usual practice, for sensing the temperature of a fluid flowing along a pipe, is to clamp a sensor to the exterior of the pipe. However, this arrangement does not always provide an accurate measure of the temperature of the fluid within the pipe, nor a quick response to changes in temperature of that fluid.

We have now devised a temperature sensing arrangement which overcomes the above-mentioned problems.

In accordance with the present invention, there is provided a sensor arrangement for sensing the temperature of a fluid flowing along a pipeway, the arrangement comprising a sensor ring mounted within a passage in a body and arranged for the fluid to pass through the sensor ring, and a temperature sensor positioned against the outer surface of the sensor ring.

The body, in which the sensor ring is mounted, may comprise a plate to be clamped between the coupling flanges of two pipes, or between the coupling flanges of a pipe and some other assembly (e.g. a valve). In some cases, the sensor ring may be mounted in the centre of the coupling flange itself of the pipe or other assembly. Instead the sensor ring may be mounted within a pipe coupling, positioned between two bodies of the coupling which are, in use, clamped together.

The temperature sensor may comprise an electrical resistance thermometer detector which is wound around the outer surface of the sensor ring. Instead, the temperature sensor may comprise a thin film sensor mounted to the outer surface of the sensor ring, preferably extending longitudinally of the sensor ring: this sensor may be located in a recess formed in a metal strip fixed to the sensor ring. In any event, one or more thermocouples may also be provided, brazed or otherwise secured to the outer surface of the sensor ring.

Preferably the sensor ring is spaced from the body in which it is mounted. Preferably this spacing is effected by a pair of thermally insulating spacer rings, positioned against

opposite ends of the sensor ring. The sensor ring may have a pair of radial flanges at or adjacent its opposite ends, between which the temperature sensor is applied: preferably the spacer rings fit against the respective radial flanges at the opposite ends of the sensor ring. Instead, the sensor ring may comprise a plain tube. Preferably the internal diameter of the sensor ring is substantially the same as the internal diameter of the pipeway through which the fluid flows.

Preferably the sensor ring has a wall thickness which is substantially less than the wall thickness of the fluid passage through the body in which it is mounted

It will be appreciated that the temperature sensor is in close proximity to the fluid flowing along the pipeway and therefore provides an accurate indication of the fluid temperature and a quick response to temperature changes. Moreover, the device does not obtrude into the fluid flow path.

Embodiments of the present invention will now be described by way of examples only and with reference to the accompanying drawings, in which:

FIGURE 1 is a longitudinal sectional view of the junction between two pipes, incorporating a first embodiment of sensor arrangement in accordance with the invention;

FIGURE 2 is a longitudinal sectional view of a second embodiment of temperature sensor arrangement provided as a pipe coupling; and

FIGURE 3 is a longitudinal sectional view of a third embodiment of sensor arrangement, shown provided as a pipe coupling but also useable as a flange coupling.

Referring to Figure 1 of the drawings, a sensor arrangement in accordance with the present invention is shown at the junction between two pipes 10,20. In conventional manner, the two pipes 10,20 are formed with radial flanges 12,22 which are formed with holes to enable the flanges to be bolted together. The sensor arrangement comprises a flat annular plate 30 positioned between the flanges 12,22 of the two pipes: gaskets 13,23 are interposed between the sensor plate 30 and the respective pipe flanges 12,22. The sensor plate 30 and gaskets 13,23 are formed with holes to align with the bolt holes in the pipe flanges, and the assembly is clamped

together by bolts (indicated at B) passed through the holes in the pipe flanges, gaskets and sensor plate.

The sensor plate 30 is formed with a central aperture having an annular rib 32 adjacent one face of the plate. Th sensor arrangement further comprises a cylindrical ring 33 having radial flanges at its opposite ends. A temperature sensor 35, in the form of an electrical resistance thermometer detector, is wound around the sensor ring 33, against its outer surface and between its radial flanges. The sensor 35 is held in place by a length of self-adhesive tape 36 wound around the sensor ring 35: the tape 36 is of a heat resistant material, preferably polyimide (available commercially under the trade name Kapton). A thermocouple may also be provided, brazed to the outer surface of the sensor ring 33.

The sensor ring 33 is positioned within the central aperture of the sensor plate 30. Preferably the sensor ring 33 and sensor plate 30 are of stainless steel. The sensor ring 33 is centred by two thermally insulating rings 37 (preferably of PTFE) which fit around the sensor ring at its opposite ends and against its respective end flanges: in particular, one face of each insulating ring 37 is formed with an annular recess, which receives the corresponding end of the sensor ring 33. The assembly of sensor ring 33 and spacer rings 37 is inserted into the sensor plate 30 from the side opposite the rib 32, so that one of the spacer rings 37 seats on the rib 32 of the sensor plate: as this assembly is inserted, the electrical leads L of the temperature sensor (and the leads of the thermocouple, where provided) are passed through a radial bore 38 formed in the plate 30. Then a retainer ring 40 is fitted into an annular recess provided in the side of the plate 30 opposite the rib 32 and the retainer ring 40 is bolted to the plate 30 to retain the sensor ring 33 in position.

The plate 30 and retainer ring 40 may be formed of steel or other metal: instead, however, either or both may be formed of plastics material.

It will be appreciated that the spacer rings 37 serve to space the sensor ring 33 from the plate 30 and also thermally insulate the sensor ring from the plate 30. This prevents the plate 30 acting as a heat sink relative to the

temperature sensor 35. The fluid flowing through the pipes 10,20 flows through the centre of the sensor ring 33, which is relatively thin so that the temperature sensor 35 is in close proximity to the fluid and therefore provides an accurate indication of the fluid temperature.

Whilst Figure 1 shows the plate 30 clamped between the radial flanges of two pipes, it may instead be clamped between the radial flanges of a pipe and some other assembly, for example a valve. Furthermore, it will be appreciated that the sensor ring 33 may be mounted in one of the flanges, instead of the separate plate.

Figure 2 shows another temperature sensor arrangement in accordance with the present invention, in the form of a pipe coupling. This pipe coupling comprises two bodies 50, 60 having tubular portions 52, 62 and radial flanges 54, 64. The tubular body portions 52, 62 are arranged to receive respective pipes, inserted into them to abut internal shoulders 51, 61: the tubular portions 52, 62 are externally screw-threaded to receive respective nuts (one being shown at 56) which, upon tightening, compress annular seals or "olives" (not shown), encircling the respective pipes, in order to effect a fluid-tight seal between the body portions 52, 62 and their respective pipes. The flanges 54, 64 of the two bodies are bolted together, with a gasket 68 interposed between them.

The co-operating faces of the two bodies 50, 60 are recessed to accommodate an assembly of a sensor ring 70 and its spacer rings 77, corresponding to the sensor ring 30 and spacer rings 37 of the arrangement shown in Figure 1. Thus, the face of body 50 is formed with an annular recess 53 providing a shoulder 55: the shoulder 55 is in turn formed with an annular recess which receives one of the spacer rings 37. The face of body 60 is formed with an annular recess which receives the spacer ring 77 at the opposite end of the sensor ring 70. The electrical leads of the temperature sensor, wound around the sensor ring 70, pass through an aperture in the side of the body 50 and through a radial tube 57.

Figure 3 shows a further temperature sensor arrangement in accordance with the present invention, also in the form of a pipe coupling. This pipe coupling comprises a main tubular

body 80 formed with an annular shoulder 81 between opposite portions of relatively small and relatively large diameter, th latter portion receiving an assembly of a sensor ring 82 and its spacer rings 83. In this case, the ring 82 comprises a plain tube, of a metal compatible with the pipeline: th opposite ends of the ring 82 are received within annular recesses in the respective faces of the spacer rings 83, which again are of thermally insulating material. The outer surface of the ring 82 is spaced from the inner surface of the tubular body 80. A temperature sensor 84 is mounted to the outer surface of the ring 82 and its electrical leads L extend through a passage formed in the tubular body 80, at an angle inclined to the axis of the latter, and through a tube 85 mounted to form an extension of that passage. In the arrangement of Figure 3, the temperature sensor 84 comprises a flat, elongate thin film sensor located in a complementary-shaped recess in a copper strip which extends lengthwise of and is soldered or welded to the ring 82: the sensor is held in position by a length of self-adhesive, heat-resistant tape (e.g. Kapton) wound around the ring 82.

The pipe coupling of Figure 3 further comprises a tubular part 86 which is screw-threaded into the end of the larger-diameter portion of the main body 80, to clamp the assembly of sensor ring 82 and its spacer rings 83 in position. Annular gaskets, e.g. 'O'-ring seals (not shown), may be provided between the spacers 83 and the end of tubular part 86 and the shoulder 81 of the main part 80, respectively. The parts 80,86 are arranged to receive respective pipes, inserted into them to abut internal shoulders 87,88. The outer end of part 86, and the opposite end of the main part 80, are externally screw-threaded to receive respective nuts which, upon tightening, compress annular seals or "olives", encircling the respective pipes, in order to effect a fluid tight seal between the parts 80,86 and their respective pipes.

Instead of receiving respective nuts, either or both parts 80,86 may have an annular flange either screw-threaded or welded to it, for clamping to a corresponding flange of another assembly.

It will be appreciated that the sensor arrangements of

Figures 2 and 3 provides the same advantages, noted above, as the sensor arrangement of Figure 1.

CLAIMS

1) A sensor arrangement for sensing the temperature of a fluid flowing along a pipeway, the arrangement comprising a sensor ring mounted within a passage in a body and arranged for the fluid to pass through the sensor ring, and a temperature sensor positioned against the outer surface of the sensor ring.

2) A sensor arrangement as claimed in claim 1, in which said body comprises a plate arranged to be clamped between respective coupling flanges of two pipes, or of a pipe and a valve or other assembly.

3) A sensor arrangement as claimed in claim 1, in which said body comprises two parts of a coupling which are clamped together.

4) A sensor arrangement as claimed in any preceding claim, in which the temperature sensor comprises an electrical resistance thermometer detector which is wound around the outer surface of said sensor ring.

5) A sensor arrangement as claimed in any one of claims 1 to 3, in which the temperature sensor comprises a thin film sensor mounted to the outer surface of said sensor ring.

6) A sensor arrangement as claimed in claim 5, in which said sensor is located in a recess formed in a metal strip fixed to the sensor ring.

7) A sensor arrangement as claimed in any preceding claim, in which said sensor ring is spaced from said body.

8) A sensor arrangement as claimed in claim 7, in which said sensor ring is spaced from said body by a pair of thermally insulating rings which are positioned against opposite ends of the sensor ring.

9) A sensor arrangement as claimed in claim 8, in which the sensor ring comprises a plain tube.

10) A sensor arrangement as claimed in claim 8, in which the sensor ring is formed with radial flanges at or adjacent its opposite ends.

11) A sensor arrangement substantially as herein described with reference to Figure 1, Figure 2 or Figure 3 of the accompanying drawings.

The Patent Office

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Claims searched: 1-11

Examiner: Paul Jefferies
Date of search: 18 December 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

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Int Cl (Ed.6): G01K 1/08, 1/18, 7/02, 7/04, 13/02; G01F 1/68, 1/684, 1/688

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2173905 A	(RADYNE LIMITED) Figure 2.	1, 4
X	GB 979616	(HONEYWELL INC.) Figure 1.	1, 4
X	EP 0185804 A1	(CISE) Figure 1.	1
X	EP 0139910 A2	(UNION RHEIN BRAUNKOHLEN) Figure 1.	1-3, 7, 8
X	US 5233868	(COATS et al.) Figure 2 and Abstract. Column 4, lines 10-40.	1, 4-6
X	US 3873102	(LOTZE et al.) Figure 1 and column 2, lines 11-18.	1-3

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.